Remarks

Entry of this amendment and allowance of all claims are respectfully requested. Claims 1-10 and 12-38 remain pending.

In accordance with 37 C.F.R. 1.121(c)(1)(ii), a marked-up version of the amended claims is provided on one or more pages separate from the amendment. These pages are appended at the end of the Response.

The claim amendments presented herewith constitute a bona fide attempt by the applicants to advance prosecution of this application and obtain allowance of certain claims and are in no way meant to acquiesce to the substance of the final rejection. It is believed that the amendments to the claims place all claims in condition for allowance.

Initially, applicants thank the Examiner for the detailed comments provided in the Office Action mailed May 25, 2001, particularly at pages 2-4 thereof. Further, applicants gratefully acknowledge allowance of claims 6, 8, 10, 14, 19, 27, 29 & 30. The Remarks which follow are directed to the remaining claims, and principally to independent claims 1, 17, 24, 31, 37 & 38.

In applicants' Response filed March 22, 2001, a number of claim errors occurred in the clean version of the claims contained in the Response. Specifically, the clean version of claims 1, 6, 8, 10, 14, 15, 16, 17, 19, 24, 27, 29, 31, 37 & 38 contained errors. The amended claims presented

herewith correct these errors previously introduced into the respective claims. All discrepancies are believed to be corrected with the Amendment presented herewith.

In the Office Action of May 25,2001, claims 1-5, 7, 9, 12, 13, 15-18, 20-26, 28 & 31-38 were rejected under 35 U.S.C. 103(a) as being unpatentable over Uz (U.S. Patent No. 5,682,204) in view of Flannaghan (U.S. Patent No. 4,703,358). This rejection is respectfully traversed, and reconsideration thereof is requested for the reasons set forth below.

The present invention addresses the problem of encoding an image containing one or more areas of significantly contrasted complexity. The invention enhances picture quality by dynamically adjusting the encoding of highly complex macroblocks to use less bits, which in turn prevents over production of bits before the encoder reaches the bottom of the picture. This invention essentially directs encoding bits from the random, busy macroblocks to the simpler, normal macroblocks. Less bits are used in the highly active and fine detail area, and thereby a more constant picture quality is ultimately obtained.

By this paper, independent claims 1, 17, 24, 31, 37 & 38 are amended to more distinctly claim certain aspects of applicants' invention. Support for the amended independent claims can be found throughout the application. For example, reference page 16, lines 15-27 and page 22, lines 17-28. No new matter is believed added to the application by any amendment presented herewith.

Applicants disclose a process for determining whether a given frame includes a noisy portion. This process uses intraframe statistics to determine without reference to another frame whether the frame includes a noisy portion. Upon determining that a noisy portion exists, applicants recite adjusting encoding of a macroblock within such a portion to reduce bits used in encoding that macroblock. This adjusting is accomplished by biasing the encoding thereof towards predictive coding, and thus, away from intra-coding of the macroblock which would be a conventional approach when complexity is detected within the macroblock.

As noted, this invention addresses the problem of encoding an image containing one or more areas of significantly contrasted complexity. The invention enhances overall picture quality by adjusting the encoding of highly complex macroblocks to use less bits. This is now recited in the independent claims to comprise biasing the coding of those macroblocks towards predictive coding, i.e., away from intra-coding of the highly complex macroblocks.

With reference to the rejection, applicants respectfully submit that a valid obviousness rejection requires that the prior art patents, when combined, teach or suggest all of the claim elements. In the instant application, there are numerous features of applicants' claims which are not taught or suggested by the Uz and Flannaghan patents, either individually or in combination.

Initially, applicants note that neither patent is directed to solving the problem identified by the present

application. Specifically, applicants disclose a technique for identifying a frame having portions of significantly contrasted complexity. For example, the application discusses a first portion comprising a noisy portion and a second portion a normal video portion. Once a frame is identified as having areas of significantly contrasted complexity, then applicants dynamically adapt encoding of certain macroblocks in a specific manner. For example, encoding of a macroblock falling within an identified noisy portion of the frame is adjusted so as to bias the coding of the macroblock towards being predictive coded. This biasing ensures that less bits are used in the highly active and fine detailed area of the frame which can then be used in the simpler, normal macroblocks, thereby providing a more constant picture quality.

Uz describes a rate control algorithm for an MPEG-2 compliant encoder. See abstract. The rate control algorithm has embodiments useful for constant bit rate and variable bit rate encoding. In particular, the Uz invention relates to a quantization based, activity based, inter/intra decision.

A careful reading of Uz fails to uncover any teaching, suggestion or implication of the problem addressed by the present invention. Uz addresses encoding a sequence of frames for constant bit rate or for variable bit rate. Further, Uz notes that the MPEG-2 specification allows a frame to be encoded as a frame picture or the two fields to be encoded as two field pictures. Frame encoding or field encoding can be adaptively selected on a frame-by-frame

basis. Frame encoding is typically preferred when the video scene contains significant detail with limited motion. Field encoding, in which the second field can be predicted from the first, is noted to work better when there is fast movement. See column 3, lines 20-29.

While Uz is directed to a rate control algorithm for encoding a sequence of frames for either constant bit rate or variable bit rate, a careful reading thereof fails to uncover any teaching, suggestion or implication of the problem addressed by the present invention. Again, the current invention addresses encoding a frame containing a noisy portion, meaning that the frame contains one or more areas of significantly contrasted complexity.

Further, applicants note that Uz suggests the use of "frame encoding" when "the video scene contains significant detail with limited motion". Column 3, lines 25-27. According to Uz, in encoding a frame containing a noisy portion (i.e., a portion with random or fast movement) field encoding is preferred. For field prediction data, one or more previous fields or previous and subsequent fields is needed. Column 3, lines 30-33. (Applicants note that the Examiner is interchanging what frame encoding and intra-frame encoding mean. Frame encoding is discussed in Uz at column 3, lines 25-28, which is distinct from intra-frame encoding.)

In accordance with the present invention, a frame being designated a noisy picture does not affect the bit budget determined for that picture by other means. What it does

affect are some of the decisions used to determine how to encode a macroblock within the noisy portion of the picture. These decisions are biased in certain directions based on the predetermination that a noisy portion is present within the picture.

The current invention adjusts the encoding of a single frame based on the difference in activity levels of the macroblocks comprising the single frame. The current invention preserves more bits for the less noisy areas of an image at the expense of the highly complex image area of the frame. Uz makes no similar adjustment (nor does Flannaghan).

This adjustment is more particularly recited in each of the independent claims presented herewith. Specifically, the independent claims have been amended to specify adjusting encoding of a macroblock when its activity level exceeds a predefined threshold indicative of the macroblock being associated with a noisy portion of a frame. The adjusting is accomplished by biased encoding of that macroblock towards predictive coding, and thus, away from intracoding. This save bits which would otherwise be used to encode the macroblock as an intracoded macroblock, and provides a more constant picture quality as a result of the encoding process. Again, Uz makes no similar adjustment to that recited by applicant.

While both Uz and the present invention calculate values for macroblocks, the two inventions implement these calculations in distinct manners. To calculate the activity

in masking activity levels, Uz uses not only the blocks comprising the current macroblock, but also the eight blocks that surround the current macroblock. Column 9, lines 20-21. In contrast, the current invention uses only information within the current macroblock in obtaining values for that macroblock. Therefore, applicants respectfully submit that these calculations are fundamentally different.

As recognized in the Office Action, a careful reading of Uz does not disclose any mention of applicants' concept of determining whether a frame includes a noisy portion. For a teaching of this concept, the Office Action references Flannaghan (in particular, column 3, lines 3-10 of Flannaghan). This characterization of Flannaghan and its applicability to the amended claims presented herewith is respectfully traversed.

Flannaghan describes an apparatus for processing a television signal including a movement detector. The detector evaluates an absolute frame difference signal on a sample by sample basis and removes unwanted noise. In the process described by Flannaghan, a frame difference which is greater than the coring threshold but surrounded by frame differences below the threshold is assumed to be noise and thus ignored. Column 3, lines 11-14. Thus, in accordance with the noise reduction scheme of Flannaghan, noise is reduced in a series of frames by essentially changing the input data, i.e., by modifying the noisy data (e.g., pixels).

There are significant differences between applicants' claimed invention and the teachings of Flannaghan. For example, applicants recite a technique for dynamically adapting encoding of a frame having a noisy portion. Advantageously, processing in accordance with the present invention prevents noisy macroblocks or blocks with random details from consuming all or most of the picture bits, which in turn prevents overproduction of bits before the encoder reaches the bottom of a given picture. The present invention essentially directs encode bits from the random, busy macroblocks to the simpler, normal macroblocks. Less bits are used in the highly active and fine detail area, thereby providing a more constant picture quality. This is further recited in the independent claims presented herewith as adapting the encoding of a macroblock within a noisy portion of a frame so as to bias the encoding thereof towards predictive coding (and thus away from intra-coding).

Applicants note that Flannaghan (as with Uz) does not address or discuss the same problem as that to which the present invention is directed. Flannaghan describes a noise reduction scheme which removes noise in a picture by changing the input data. A careful reading of Flannaghan fails to uncover any discussion directed to a dynamic encode approach which prevents noisy macroblocks or blocks with random details within a frame from consuming all or most of the picture bits for that frame. For this reason, applicants respectfully submit that one of ordinary skill in the art would not have combined the teachings of Flannaghan

and Uz to arrive at a dynamic encode approach as recited in the independent claims presented herewith.

Further, a careful reading of Flannaghan fails to uncover any teaching, suggestion or implication that intraframe statistics can be employed alone, without reference to another frame, to determine whether the given frame includes a noisy portion. Noise is defined in Flannaghan as a difference of signal A with a signal from a previous frame (see column 2, lines 42-45). For this additional reason, applicants respectfully submit that the Office Action combination of Uz and Flannaghan fails to teach or suggest all of the claimed elements. Thus, applicants respectfully request reconsideration and withdrawal of the obviousness rejection to the independent claims based upon the teachings thereof.

Still further, as amended the independent claims presented herewith recite adjusting encoding of a macroblock within a noisy portion of a frame so as to bias the coding thereof towards predictive coding (and thus away from intracoding). A careful reading of both Uz and Flannaghan fails to uncover any teaching, suggestion or implication of such a concept. As noted by the examiner in the Office Action, Uz discloses intra-frame encoding in column 3, lines 25-28 where Uz states "(intra-)frame encoding is typically preferred when the video scene contains significant detail". Applicants respectfully submit that Uz thus teaches away from the present invention since applicants do not seek to intra-code the noisy portion of a frame. This difference

relates to the unique problem addressed by the present invention.

To summarize, applicants respectfully submit that there invention as recited in the independent claims presented herewith would not have been obvious to one of ordinary skill in the art based on the teachings of Uz and Flannaghan. Neither patent addresses or discusses the same problem as that to which the present invention is directed. Although applicants recognize that Uz describes an adaptive encoding approach, the problem addressed therein, how the adaptation occurrs, as well as the specific adaptation are different from that of the adaptive encoding approach of the present invention. The current invention addresses encoding an image containing a noisy portion. Further, Flannaghan expressly teaches away from applicants' claimed adaptation by noting that intra-frame encoding is typically used when a video scene contains significant detail.

The secondary citation to Flannaghan teaches a noise detection and noise removal technique. Noise is defined as the difference of signal A with a signal from a previous frame. Flannaghan teaches a scheme to remove noise in a picture by changing the input data. In contrast, applicants recite using intra-frame statistics to determine without reference to another frame whether a current frame includes a noisy portion, and if so, applicants recite dynamically adjusting encoding of one or more macroblocks within that frame by biasing the coding thereof towards predictive coding. In applicants' approach, the noisy portion of the frame is encoded as is without any alteration of the data.

This is contrasted with Flannaghan which expressly teaches alteration of the data.

For all the above reasons, applicants respectfully submit that the independent claims presented herewith patentably distinguish over Uz and Flannaghan, both individually and in combination.

The dependent claims are believed allowable for the same reasons as the independent claims from which they depend, as well as for their own initial characterizations.

With reference to claim 7, applicants note that the independent claims presented herewith each now expressly recite that a macroblock within a noisy portion is biased predictive coded when the macroblock exceeds the predefined threshold. A careful reading of column 11, lines 20-26 of Uz fails to uncover any teaching, suggestion or implication of such a concept.

In claim 9, applicants recite that the adjusting encoding (iii) includes determining an adjusted quantization level for use in encoding the macroblock. This adjusted quantization level is determined to conserve bits used in encoding the macroblock when the macroblock activity level exceeds the predefined threshold. In comparison, Uz discloses a scheme to adjust the quantization step size (Col. 12, line 50-53) based on the bits used. This calculation is referred to in the present application as CAL QL. In claim 9, the CAL QL is adjusted further in order to conserve bits because the macroblock has been found to be a

noisy macroblock in a noisy portion of the frame. The adjusted quantization step size is referred to in the present application as ADJ QL.

In claims 12 & 13 applicants recite that the determining whether a noisy portion exists within a frame includes calculating a frame complexity value and comparing the frame complexity value to a predefined complexity threshold. In claim 13, the frame complexity value is defined as an accumulated absolute difference value (PIX DIFF) derived from adjacent pixels of the plurality of pixels in the frame. In comparison, the complexity measure in Uz is very different from that recite by applicants. Uz's complexity measurement is calculated after encoding the data. In contrast, applicants claims 12 & 13 is based on unencoded input picture pixels and is calculated before encoding the frame.

In claim 26, applicants recite a system for determining a macroblock activity level wherein the macroblock comprises multiple blocks. The system includes means for determining an activity level for each block of the macroblock, and means for ordering activity levels of the blocks and comparing the minimum activity level with the next to minimum activity level to derive an activity level for the macroblock.

In rejecting this claim, the Office Action acknowledges that Uz does not teach the determination of an activity level, and then states: "However, Uz fails to disclose the comparison of a minimum activity level of said order with a

next minimum activity level of said order to derive said activity level for said macroblock as disclosed by the applicant. Therefore, it would have been obvious to one of ordinary skill in the art to compare the minimum activity level of said order with a next minimum activity level of said order to derive said activity level for said macroblock for encoding accuracy and efficiency." Applicants respectfully submit that a prima facie case of obviousness has not been stated against claim 26 based upon this language.

Specifically, Uz computes its values by using the minimum values from the blocks within the macroblock as well as those surrounding the macroblock. Col. 9, lines 12-21. Therefore, Uz always uses the minimum value calculated from blocks within and surrounding the macroblock as the value for the macroblock. In contrast, the current invention prioritizes the block values of those blocks contained within the macroblock from minimum to maximum. The invention then derives the macroblock activity level by comparing the minimum and next to minimum values. As much as Uz can be applied to the current invention, Uz teaches away from both the use of information exclusively within the macroblock, as well as the use of a value other than the minimum as an activity level for the macroblock.

Obtaining the minimum value as taught by Uz does not require the ordering of values as recited by applicants. Applicants respectfully submit that the ordering of all block values is not disclosed, taught or suggested by Uz's use of the minimum value in calculating macroblock values.

In view of the above, allowance of all claims presented herein is respectfully requested. If, however, any issue remains unresolved, the examiner is invited to telephone applicants' undersigned representative to further discuss the application.

Respectfully submitted,

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Marked-Up Version of Claims

1. (Thrice Amended) A method for encoding a frame having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without reference to another frame [[determining]] whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock by biasing coding of said macroblock associated with said noisy portion of said frame towards predictive coding and thereby save bits otherwise used to encode said noisy portion of said frame and provide a more constant picture quality due to encoding of the frame.

6. (Twice Amended) [[The method of claim 5,]] A method for encoding a frame having a plurality of macroblocks, said method comprising:

determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

wherein each macroblock of said plurality of macroblocks comprises multiple blocks, and wherein said determining (i) comprises determining an activity level for each block of said multiple blocks of said macroblock, and deriving therefrom an activity level for said macroblock;

wherein said deriving comprises ordering activity levels of said multiple blocks of said macroblock and comparing a minimum activity level of said order with a next to minimum activity level of said order to derive said activity level for said macroblock;

wherein said comparing further comprises comparing said minimum activity level of said order with an average activity level of said multiple blocks of said macroblock to derive said activity level for said macroblock; and

wherein said comparing comprises determining whether said minimum activity level is less than one-half said next to minimum activity level and whether said minimum activity level is less than one-half said average activity level of said multiple blocks, and when both are so, defining said activity level of said macroblock as said next to minimum activity level of said order, otherwise defining said activity level of said macroblock as said minimum activity level of said order.

8. (Twice Amended) [[The method of claim 7,]] A method for encoding a frame having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without reference to another frame [[determining]] whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame; [. determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame;]

[determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;]

wherein said adjusting [and coding] <u>encoding</u> (iii) comprises performing motion estimation on said macroblock and selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing motion estimation on said macroblock; and

wherein said selectively adjusting comprises determining when said predictive error is greater than a second predefined threshold and said predictive error is greater than one-half said macroblock activity level, and when both are so, adjusting a macroblock coding type parameter to bias said macroblock towards being coded predictive.

10. (Twice Amended) [[The method of claim 9,]] A method for encoding a frame having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without reference to another frame whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

[determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblockactivity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;]

wherein said adjusting [and coding] encoding (iii) comprises determining an adjusted quantization level for use in encoding said macroblock, said adjusted quantization level being determined to conserve bits used in encoding said macroblock when said macroblock activity level exceeds said predefined threshold; and

wherein said determining of said adjusted quantization level comprises calculating a quantization level (CAL QL) for said macroblock and defining said adjusted quantization level (ADJ QL) as:

ADJ QL=MIN((1 + 0.25 (TH2 - BR + 1))·CAL QL; MAX ALLOWED BY STANDARD)

Where: BR is the target bitrate;
TH2 is a second predefined value; and
MAX QL ALLOWED BY STANDARD is a maximum quantization level allowed by MPEG standard

14. (Twice Amended) [[The method of claim 13,]] A method for encoding a frame having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without reference to another frame whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

[determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macro- block activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;]

wherein said determining whether said frame comprises said noisy portion includes calculating a frame complexity value and comparing said frame complexity value to a predefined complexity threshold;

wherein said frame comprises a plurality of pixels, and wherein each pixel of said frame comprises a multi-bit value, and wherein said frame complexity value comprises an accumulated absolute difference value (PIX-DIFF) derived from adjacent pixels of said plurality of pixels of said frame; and

wherein said PIX-DIFF is defined as:

$$\sum_{y=1,3,5\ldots}^{Max} |L_y - L_{y+1}|$$

Where: L represents luminance value of a pixel, and y represents pixel position within the frame.

15. (Twice Amended) [[] The method of claim 13, []] further comprising setting a noisy picture flag to "0" when said frame complexity value is less than said predefined complexity threshold, wherein said flag set to "0" designates said frame as a non-noisy or normal frame.

16. (Twice Amended) [[] The method of claim 13, []] wherein said determining whether said frame comprises said noisy portion further includes comparing a target bitrate for said frame to a predefined bitrate threshold and when said target bitrate for said frame exceeds said predefined bitrate threshold, said method further comprises setting a noisy picture flag equal to "0", wherein said flag set to "0" designates said frame as a non-noisy or normal frame, and if said target bitrate is less than said predefined bitrate threshold, then setting said noisy picture flag to "1", wherein said "1" noisy picture flag setting indicates said frame includes said noisy portion.

17. (Twice Amended) A method for encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without reference to another frame [[determining]] whether said frame includes a random noise portion; and

when said frame includes said random noise portion, evaluating each macroblock of said plurality of macroblocks in said frame and adjusting encoding of at least some macroblocks thereof within said random noise portion of said frame, said adjusting comprising reducing bits used in encoding said at least some macroblocks within said random noise portion <u>by biasing coding thereof towards predictive coding</u>.

19. (Twice Amended) [[The method of claim 18,]] A method for encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said method comprising:

[using intraframe statistics to determine without reference to another frame [determining]] <u>determining</u> whether said frame includes a random noise portion; and

when said frame includes said random noise portion, evaluating each macroblock of said plurality of macroblocks in said frame and adjusting encoding of at least some macroblocks thereof within said random noise portion of said frame, said adjusting comprising reducing bits used in encoding said at least some macroblocks within said random noise portion;

wherein [in] each frame of the sequence of frames comprises a plurality of pixels, each pixel of each frame comprising a multi-bit value, and wherein said determining whether said claim includes said random noise portion includes calculating a frame complexity value and comparing said frame complexity value to a predefined complexity threshold, said calculating of said frame complexity value including deriving an accumulated absolute difference (PIX-DIFF) from adjacent pixels of said plurality of pixels of said frame; and

wherein said deriving of said PIX-DIFF comprises forming a string of pixels by concatenating said plurality of pixels of said frame and defining PIX-DIFF as:

$$\sum_{y=1,3,5\ldots}^{Max} |L_y - L_{y+1}|$$

Where: L represents luminance value of a pixel, and y represents pixel position within the string of pixels.

24. (Thrice Amended) A system for encoding a frame comprising a plurality of macroblocks, said system comprising:

means for using intraframe statistics to determine without reference to another frame [[determining]] whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) means for determining a macroblock activity level;

(ii) means for determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) means for adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock <u>by biasing coding of said macroblock associated with said noisy portion of said frame towards predictive coding</u> and thereby save bits otherwise used to encode said noisy portion of said frame <u>and provide a more constant picture quality due to encoding of the frame</u>.

27. (Twice Amended) [[The system of claim 26,]] A system for encoding a frame comprising a plurality of macroblocks, said system comprising:

means for [using intraframe statistics to determine without reference to another frame] determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) means for determining a macroblock activity level;

(ii) means for determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) means for adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

wherein each macroblock of said plurality of macroblocks comprising multiple blocks, and wherein said means for determining (i) comprises means for determining an activity level for each block of said multiple blocks of said macroblock, and means for ordering activity levels of said multiple blocks of said macroblock and comparing a minimum activity level

of said order with a next to minimum activity level of said order to derive an activity level for said macroblock; and

wherein said means for comparing comprises means for determining whether said minimum activity level is less than one-half said next to minimum activity level and whether said minimum activity level is less than one-half an average activity level of said multiple blocks, and when both are true, for defining said activity level of said macroblock as said next to minimum activity level in said macroblock, otherwise for defining said activity level of said macroblock as said minimum activity level of said order.

29. (Twice Amended) [,] A system for encoding a frame comprising a plurality of macroblocks, said system comprising:

means for determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) means for determining a macroblock activity level;

(ii) means for determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) means for adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

wherein said means for adjusting encoding (iii) comprises means for performing motion estimation on said macroblock and for selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing of motion estimation on said macroblock; and

wherein said means for selectively adjusting comprises means for determining when said predictive error is greater than a second predefined threshold and when said predictive error is greater than one-half said macroblock activity level, and when both are so, said means for selectively adjusting comprises means for adjusting a macroblock coding type parameter to bias said macroblock towards being coded predictive.

31. (Twice Amended) A system for encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said system comprising:

a pre-encode processing unit for using intraframe statistics to determine without reference to another frame [[determining]] whether said frame includes a random noise portion; and

a control and encode unit for evaluating each macroblock of said plurality of macroblocks in said frame when said frame includes said random noise portion, said control and encode unit including means for adjusting encoding of at least some macroblocks within said random noise portion of said frame to reduce bits used in encoding said at least some macroblocks within said random noise portion <u>by biasing coding thereof towards predictive coding</u>.

33. (Twice Amended) The system of claim 32, wherein when said frame complexity value is less than said predefined complexity threshold, said pre-encode processing unit further comprises means for setting a noisy picture flag to "0" and performing normal encoding on said frame, wherein said flag set to "0" designates [deignates] said frame as a non-noisy or normal frame, and when said frame complexity value is greater than said predefined complexity threshold, said pre-encode processing unit comprises means for determining whether a target bitrate of said frame is less than a predefined bitrate threshold, and when said target bitrate of said frame exceeds said predefined bitrate threshold, said pre-encode processing unit comprises means for setting said noisy picture flag to "0", and when said target bitrate of said frame is less than said predefined bitrate threshold, said pre-encode processing unit comprises means for setting said noisy picture flag to "1", wherein said "1" noisy picture flag setting indicates that said frame includes said random noise portion.

37. (Thrice Amended) A computer program product comprising a computer usable medium having computer readable program code means therein for use in encoding a frame comprising a plurality of macroblocks, said computer readable program code means in said computer program product comprising:

computer readable program code means for causing a computer to affect using intraframe statistics to determine without reference to another frame [[determining]] whether said frame includes a noisy portion, and if so, then for each macroblock of said frame said computer program comprises:

computer readable program code means for causing a computer to affect determining a macroblock activity level;

computer readable program code means for causing a computer to affect determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

computer readable program code means for causing a computer to affect adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock by biasing coding of said macroblock associated with said noisy portion of said frame towards predictive coding and thereby save bits otherwise used to encode said noisy portion of said frame and provide a more constant picture quality due to encoding of the frame.

38. (Twice Amended) A computer program product comprising computer usable medium having computer readable program code means therein for use in encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said computer readable program code means in said computer program product comprising:

computer readable program code means for causing a computer to affect using intraframe statistics to determine without reference to another frame [[determining]] whether said frame includes a random noise portion; and

computer readable program code means for causing a computer to affect evaluating each macroblock of said plurality of macroblocks in said frame and when said frame includes said random noise portion, adjusting encoding of at least some macroblocks within said random noise portion of said frame, said adjusting comprising reducing bits used in encoding said at least some macroblocks within said random noise portion <u>by biasing coding thereof towards predictive coding</u>.